M I C H I G A N

Blueberry Newsletter

A newsletter from Michigan State University for the Michigan blueberry industry

May 4, 2010 Volume 4, Issue 5

Ottawa Co. grower meeting this Thursday!
See Page 8 for details.

MICHIGAN STATE UNIVERSITY

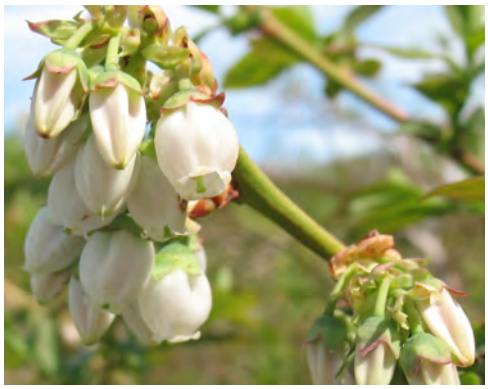
News you can use

Disease management. If blossoms are open and mummy berry shoot strikes are present, there is a risk of flower infection. Flowers are most susceptible on the day they open.

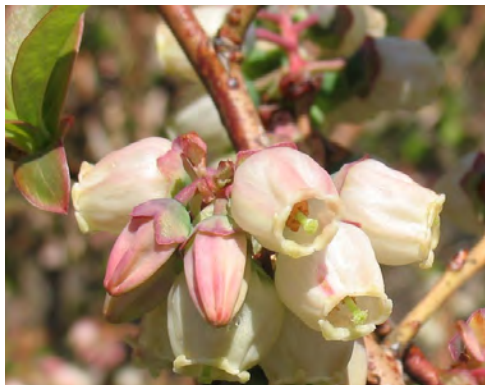
Insect management. Get honey bees into your fields as soon as possible! Cranberry fruitworm traps should be up. Early season leafrollers and Tussock moth larvae are active. Begin checking fields for aphids.

Grower Meeting this Thursday in Ottawa County. A pre-bloom blueberry grower meeting is scheduled for the evening of May 6th, 6 to 8 PM, at Carini Farms. Carini Farms is located at 15039 Port Sheldon Rd. in West Olive. The farm is located on the north side of Port Sheldon Rd., approximately 1.6 miles west of US-31.

Crop development. In Van Buren County, Jersey in Covert is at 25% bloom, and Bluecrop and Blueray are at full bloom in Grand Junction. In Ottawa County, Blueray in Holland and Rubel and Bluecrop in West Olive are nearing 25% bloom.



Jersey at 25% bloom in Covert



Blueray at 25% bloom in Holland

GROWING DEGREE DAYS — From March 1

	2010		Last Year	
	Base 42	Base 50	Base 42	Base 50
Grand Junction, MI				
4/26	497	255	327	154
5/3	619	333	427	208
Projected for 5/10	704	377	545	276
West Olive, MI				
4/26	422	197	234	97
5/3	528	259	314	135
Projected for 5/10	609	297	422	194

See http://enviroweather.msu.edu for more information.

Not sure why your blueberries are sick? Consider a free virus test of your plants.

The Small Fruit Pathology lab at MSU is conducting a survey of the current state of blueberry virus problems in Michigan. We are offering a free test of blueberry plant material that is exhibiting unusual symptoms that might be caused by a virus. We will be testing for blueberry shoestring virus, blueberry leaf mottle virus, tomato ringspot virus, tobacco ringspot virus, peach rosette mosaic virus, blueberry scorch virus, and blueberry shock virus.

This is a win-win situation! You are able to get some free testing, and we are able to assess the future research needs of our industry.

We will be ready to receive samples at the twilight grower meetings on May 6, June 10, and June 17. You are invited to bring samples from your blueberry planting that you would like to be virus tested.

Questions? Please contact:
Jerri Gillett, Research Assistant
MSU Plant Pathology
Email: gillett@msu.edu
Lab phone: 517-355-7539

OPTION 1:
BRING YOUR SAMPLES TO ONE OF THE GROWER MEETINGS

If you have samples you want tested, please do the following:

1. Make sure it is a fresh sample (sampled within 24 hours of the meeting) and kept refrigerated until leaving for the meeting. Placing the sample in a zip-lock bag with a moist paper towel usually works well.
2. Be sure to take symptomatic tissue. If tissue is necrotic, be sure to also include green tissue taken from near the necrotic tissue.
3. Write your name and contact information, as well as the variety of blueberry, on the sample bag. Include any other information you think is pertinent (e.g. how long the problem has been observed, etc). **If you use email, please include an email address.**
4. Keep samples separate. Place tissue from only one bush in each bag, but feel free to bring multiple bags.

OPTION 2:
SHIP YOUR SAMPLES DIRECTLY TO MSU

If you can't personally deliver your samples at one of the twilight grower meetings, you may ship samples OVERNIGHT to arrive on any of the following days: May 6, June 10, or June 17. Please follow the same sampling procedures.

Shipping address:
Jerri Gillett
Department of Plant Pathology
Michigan State University
105 CIPS Building
East Lansing, MI 48824
Phone: 517-355-7539

More shoot strikes

This week, mummy berry shoot strikes were observed at all of our scouted plots in Southwest Michigan, with the highest increase at the West Olive site (average of 17 shoot strikes per bush). Low numbers of shoot strikes were observed at the other sites. Both new (Figure 1) and advanced (Figure 2) shoot strike symptoms were observed and numbers will likely increase this week. Shoot strike symptoms consist of wilting of developing leaves and shoots with a browning of the midribs and lateral leaf veins, often described as an "oak leaf" pattern of necrosis. Under humid conditions, gray spore masses will develop on these infected shoots. These spores (conidia) then get carried to the flowers by bees and other pollinating insects, wind, and rain, which then lead to infection and mummification of the fruit later in the growing season. Since most of the scouted plots are in partial bloom, protect the blossoms from

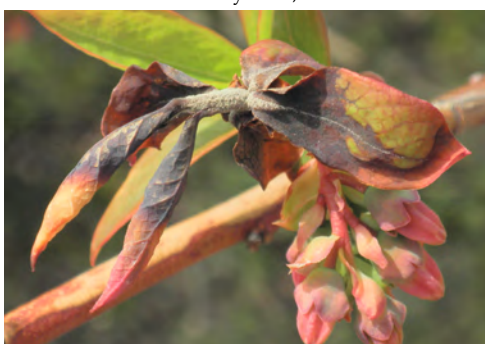
Fig 1. Early-stage shoot strike symptoms observed near West Olive on 3 May 2010; *Photo: T. Miles.*

infection with a fungicide application (e.g., Indar or Pristine) if shoot strikes are observed and open blossoms are present in your field. It is important to protect blossoms at an early stage because flowers are the most susceptible right after they open, and susceptibility decreases over time. Once the fungus reaches the ovaries, it colonizes the developing berry.

Precipitation helps remaining apothecia

Apothecia were observed at three of the four scouted plots this week. Overall the numbers were much reduced compared to previous weeks. The remaining apothecia appeared to be more hydrated

Fig 2. Late-stage shoot strike symptoms observed near West Olive on 3 May 2010; *Photo: T. Miles.*



and the surrounding soil appeared wetter because of the rainfall we experienced over the weekend. The highest number of apothecia was found at the West Olive site, averaging 1 apothecium on the ground per bush (Figure 3). Except for the northern growing regions, the risk of ascospore infection of shoots is minimal because

Fig 3. A few apothecia still being observed near West Olive on 3 May 2010; *Photo: T. Miles.*

few apothecia remain and leaves have expanded in many of the plots and most blueberries are already in partial bloom.

For more information about mummy berry symptoms, biology, and management practices, check out the Mummy Berry Fact Sheet (http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E2846.pdf).

Tim Miles & Annemiek Schilder
Department of Plant Pathology
Michigan State University

Table 1. Disease scouting results.

Farm	Date	% Germinated mummies**	Avg number of apothecia on the ground*	Max apothecia cup diameter (mm)	Avg number of shoot strikes per bush*
		VAN BUREN COUNTY			
Covert	4/26	0	0	n/a	0
	5/3	0	0	n/a	0.8
Grand Junction	4/26	4.4	7.6	6	0.5
	5/3	<0.1	0.1	2	1.5
		OTTAWA COUNTY			
Holland	4/26	0.0	0	n/a	0
	5/3	1.5	0.1	2	1.4
West Olive	4/26	18.3	14.1	9	0.9
	5/3	1.9	1.0	3	17.0

**Average of 10 bushes; **Number of germinated mummies divided by the number of total mummies.*

Use strobilurin fungicides wisely to avoid fungicide resistance development

Strobilurins are fungicides that are modeled after an antifungal substance produced by a small forest mushroom called *Strobilurus tenacellus*. This mushroom grows on pine cones and uses an antifungal substance to suppress other fungi which may be competing for the same food source. Synthetic strobilurins were made to be more resistant to UV light degradation than the natural chemical produced by *S. tenacellus*. All strobilurins have the same mode of action, i.e., they inhibit the electron transfer in mitochondria, disrupting respiration and thereby causing the fungus to run out of energy and halt growth. Strobilurins belong to the group of QoI's (quinone outside inhibitors) based on the specific site that they inhibit. They include azoxystrobin (Abound), kresoxim-methyl (Sovran), pyraclostrobin (Cabrio) and trifloxystrobin (Flint). The fungicide Pristine is a mixture of pyraclostrobin and boscalid. Boscalid is not a strobilurin but belongs to the chemical class of the carboxamides. Interestingly, some of the strobilurins also have phytotoxicity to certain plant species; e.g., Abound is phytotoxic to apples and Sovran is phytotoxic to certain sweet cherry varieties. Pristine and Flint are phytotoxic to Concord grapes. Caution must be taken when applying these products in the vicinity of sensitive crops.

Since their first EPA registration in 1997, strobilurins have become valuable tools for managing diseases in numerous crops, including blueberries, because of their broad spectrum of activity against different groups of fungal pathogens. In blueberries, they are especially effective against fruit rots, but also have efficacy against Phomopsis twig blight and, to a lesser extent, against mummy berry. They are also systemic, quickly rainfast, and have translaminar activity, which means they can move from one side of a leaf to the other thereby providing disease control on both leaf surfaces. Strobilurins have outstanding ability to inhibit spore germination, thus they should be most useful early in disease development. The do not have a lot of "back action". Some strobilurins (e.g., Abound and Flint) are listed as "reduced-risk" by the EPA, which means that they have relatively low mammalian toxicity. However, they are toxic to fish and other aquatic organisms.

Since strobilurins have a site-specific mode of action, they are unfortunately prone to fungicide resistance development in target fungi. Where strobilurin resistance has occurred, the pathogen strains have exhibited a high level of resistance that cannot be overcome by increasing the fungicide application rate. Continued and exclusive use of strobilurin fungicides may allow resistant strains to build up over time and may lead to control failure and loss of the fungicide as a disease management tool. While no resistance has been reported in blueberry pathogens, there is still a risk, particularly with those that have multiple generations during a growing season, e.g., *Colletotrichum acutatum*. Therefore it is important to limit the risk of resistance development by reducing the number of strobilurin applications, for instance by integrating strobilurins in a program with other fungicides and non-chemical management practices, such as sanitation and canopy management. In addition, regular disease scouting is important to determine the need for fungicide sprays as well as determining the efficacy of disease management tactics. The goal is not to manage resistance once it has developed, but rather to prevent or delay the development of fungicide resistance in the first place. The labels of strobilurin fungicides limit the number of applications (total and sequential) per season (Table 1). It is advisable to alternate strobilurins with block treatments (2 to 3 sprays) of registered fungicides with a different mode of action (see E-154 Michigan Fruit Management Guide). Tank-mixing strobilurins with other fungicides is usually not necessary or cost-effective since they already have a broad spectrum of activity. The fungicide program should include multi-site contact fungicides that have a low risk of resistance development, such as Bravo, Captan, and Ziram, or biological control agents, such as Serenade. Using various fungicides in alternation with strobilurins will also minimize yield loss should resistance develop. Do not use more then four (and preferably fewer) applications of any strobilurin fungicide per season.

Annemiek Schilder
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Michigan State University

Table 2. Summary of label information for strobilurin fungicides for blueberries, 2010.

Product	Active Ingredient	Recommended rate per acre	Max. rate per acre per season	Max. number of sequential applications	REI (hours)	PHI (days)
Abound F	azoxystrobin (22.9%)	6.2-15.4 fl oz	46 fl oz	2	4	0
Cabrio EG	pyraclostrobin (20%)	14 oz	56 oz	2	12	0
Pristine	pyraclostrobin (12.8%) + boscalid (25.2%)	18.5-23 oz	92 oz (max 4 applications)	2	12	0

Insect activity is on the rise

Insect activity at the farms we scouted has increased with the warm temperatures that have occurred over the last week. Leafroller larvae (Figures 4 and 5) were seen at the Covert, Grand Junction and West Olive farms, and a newly hatched tussock moth larva was seen at the West Olive farm. Continued

Fig 4. A leafroller up close; *Photo: P. Jenkins.*

mild temperatures are expected this week and insect activity should remain steady. Growers and scouts should continue to check fields for feeding damage by leafroller, and tussock moth during the next week. These pests are generally more common in areas bordering woods. Flower feeding beetles were not detected at any of the farms we visited, and we do not expect to see this pest any more this season. Aphids were not seen at any of the fields we scouted; however growers and scouts should begin checking bushes for aphid colonies.

Fig 5. A leafroller chews through a blueberry leaf; *Photo: P. Jenkins.*

To scout for aphids, examine two young shoots near the crown on each of 10 bushes and record the number of shoots where aphids are found. Also record the number of shoots with parasitized aphids. Be sure to sample weekly from as wide an area in the field as possible to have a better chance of detecting whether aphids are present. Although natural enemies (parasitic wasps, lady beetles, lacewings, hover fly larvae) can keep this pest in check, aphids can transmit blueberry shoestring virus, so growers may want to consider using an insecticide to control aphids if there are blueberry varieties that are susceptible to shoestring on the farm.

Cherry fruitworm moths were caught at the Covert and Grand Junction farms. We expect the flight for this pest to increase in the next week. Growers and scouts should have already set traps for cherry fruitworm. Cranberry fruitworm traps should be set this week to ensure detection of the start of the flight for this pest. Traps should be checked twice weekly until moths are caught consistently. This will not only identify fields with pressure from fruitworm pests, but also enable the timing of the start (biofix) of the cranberry fruitworm model on enviroweather.msu.edu. This model can be used for predicting optimal spray application dates for controlling cranberry fruitworm.

Fig 6. Cherry fruit worm; *Photo: S. Van Timmeren.*

Captures of the contaminant moth, Pseudexentera vaccinii in cherry fruitworm traps has declined, and we expect this downward trend to continue through next week. The contaminant moth is ~½ inch long which is much larger than cherry fruitworm which is ~¼ inch long. Cherry fruitworm also have an iridescent banding pattern across the wings while the contaminant moth has darker markings on a light gray body. See Figures 6 and 7 to help with identification.

Keith Mason & Rufus Isaacs
Department of Entomology
Michigan State University

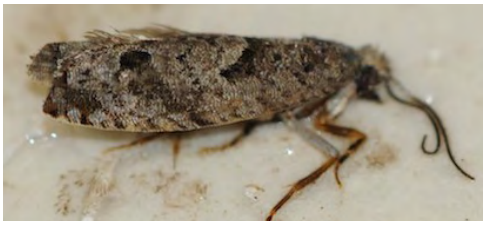


Fig 7. The contaminant found in cherry fruitworm traps, *Pseudexentera vaccinii; Photo: P. Jenkins.*

Table 3. Insect scouting results.

Farm	Date	CFW moths per trap	CBFW moths per trap	BBA % infested shoots	BBM adults per trap	JB per 20 bushes
			VAN BUREN COUNTY			
Covert	4/26	0	--	--	--	--
	5/3	1	*set*	--	--	--
Grand Junction	4/26	0	--	--	--	--
	5/3	1	*set*	--	--	--
			OTTAWA COUNTY			
Holland	4/26	0	--	--	--	--
	5/3	0	*set*	--	--	--
West Olive	4/26	0	--	--	--	--
	5/3	0	*set*	--	--	--

Cranberry fruitworm management in blueberries

Cranberry fruitworm and cherry fruitworm are two early-season moth pests of blueberries in eastern North America. Both species have one generation per year and the female moths lay eggs during and after bloom, with cherry fruitworm activity being 7-10 days earlier than cranberry fruitworm. The larvae of both species develop inside berries through the period of fruit development, and left unchecked these insects can infest 50 to 75% of clusters in areas of high populations. This causes risk of reduced yield and load rejection, due to a very low tolerance for insects in fruit destined for the processing or fresh markets. Effective management of fruitworms requires understanding how to monitor and scout for these insects, knowledge of their emergence and egglaying, and the performance of the available control options. Combining these approaches into an IPM program can help ensure that fruitworms do not cause economic losses. This document explains how to use the MSU degree day model for fruitworm management, and we report on some recent trials to test the performance of IPM programs that tested the degree day model and alternatives to Guthion. This insecticide has been the foundation of fruitworm control programs for years, but it is being phased out by 2012. Blueberry growers have many alternatives available and should be testing alternative programs on their farms to be prepared for this change.

Monitoring. Traps for cherry fruitworm should be placed in fields before bloom, while cranberry fruitworm can be placed at the start of bloom. These timings should provide a week or two of zero catches before moths are detected, to ensure accurate identification of the start of flight. This allows setting the biofix for running the degree day model to time insecticide applications (see below).

For both fruitworm species, we recommend placing white monitoring traps in the upper third of the bush, with foliage cleared near the entrances. Field edges near woods or tree-lines tend to have the highest catches, so place traps near these areas for the greatest chance of catching moths. Growers with multiple fields should be monitoring more than one area of the farm, including areas that have been hot-spots for fruitworm pressure in the past. One trap per 10 acres is a minimum density to determine which fields have the most pressure and to detect differences in timing of emergence. The large plastic delta traps work well for monitoring both fruitworm species, but smaller Pherocon or wing traps can work too. The plastic delta traps are useful because they are highly resistant to rain, irrigation, and tractors, plus this design can usually be used for more than one year. As with all pheromone monitoring traps, be careful to bait the trap with the pheromone lure for the right species, and be sure to avoid cross-contamination with other species' pheromone.

Some contaminant moths can be attracted to fruitworm traps in the spring, so be sure that the number counted are the right species. Once the period of moth emergence is near (early bloom for cherry fruitworm, mid-bloom for cranberry fruitworm), traps should ideally be checked twice a week. This will help ensure accurate identification of the start of moth flight, or biofix.

Degree days to predict fruitworm phenology. Cherry and cranberry fruitworm flights usually start during bloom in mid May, with egglaying starting in late May during bloom when bee safety is a high priority. Farms with low fruitworm pressure can often get by with using an immediate post-bloom insecticide in early June as their first fruitworm spray. However, at fields and farms with higher pressure from these fruitworm pests, gaining high levels of control requires protection of berries using sprays applied during bloom. Additionally, sprays would ideally be applied based on the phenology of the pest, not the crop, which can vary widely among blueberry cultivars. Using degree days can help predict fruitworm phenology and identify the ideal times for sprays.

The activity of bees during bloom means that growers are restricted to only a few bee-safe products at the predicted start of egglaying: the insect growth regulators (IGRs) Intrepid or Confirm, and the biological insecticide B.t. Intrepid or Confirm must be applied close to the start of egglaying, which is timed by tracking growing degree days (GDDs) with a base temperature of 50°F. Egglaying is predicted to start at 85-100 GDD after the first sustained catch of cranberry fruitworm moths. For cherry fruitworm, it is not well understood how long after biofix egglaying starts. However, there is some guidance available from our recent trials in which Intrepid applied 100 GDD after biofix for CFW worked well to control this pest.

The cranberry fruitworm model on Enviroweather. The MSU Enviroweather system (www.enviroweather.msu.edu) can be used to track degree days for the weather station nearest to your farm. Click on the nearest weather station, select "Fruit" and then pick "Cranberry Fruitworm Model" from the list of available models. This will bring up a table that shows dates across the top and down the side. Select the date across the top when you set biofix for your farm (first sustained moth catch), and then look down the table to where it changes to red. This is the date when egglaying is predicted to start at that site. This model also predicts forward one week to show degree day accumulation and whether egglaying is expected in the coming days.

Continued next page

A model for cherry fruitworm is in development for displaying at the Enviroweather page, but that is not yet ready to release online.

Insecticides for fruitworm control.

In bloom. Both species of fruitworms lay their eggs in the calyx cup of blueberries, so the risk from these pests starts when moths are present, egglaying is predicted, and petal fall has started. If these conditions are met, protection of the young fruit should be considered. If warm weather brings a new round of petal-fall, growers with fields at high risk of fruitworm infestation should consider protecting these newly-exposed fruit.

If cranberry fruitworm moths are trapped and 85-100 GDD have elapsed from biofix, young berries should be protected using an IGR such as Intrepid at 10-12 oz/acre. For organic growers using B.t. formulations such as Dipel at 1-2 lb/acre or Javelin at 1 lb/acre, applications should be timed for egg hatch which is a little later than egglaying. Although we do not have our research on egg hatch timing completed yet, we expect that to be another 50-100 GDD later, equivalent to 135-200 GDD after biofix. Applications of B.t. last 3-5 days under typical spring conditions and they are not rainfast, so reapplication is critical for crop protection during this period. In contrast, Intrepid has 10-14 days residual control and is the preferred option for non-organic growers.

EPA has released new Endangered Species restrictions for Intrepid that cover Allegan, Monroe, Montcalm, Muskegon, Newaygo and Oceana counties in Michigan. This restriction states "*Do not apply this product within one mile of sandy habitats that support wild lupine plants...*". See the Bulletin Live website for details.

Post bloom. Guthion, Imidan, Asana, Danitol, Sevin, and Assail are all rated as being excellent broad-spectrum insecticide options for control of fruitworms. Lannate can provide high activity but has shorter residual control. There have also been recent registrations of the reduced-risk insecticides Delegate, Rimon, and Avaunt that are registered for fruitworm and provide good levels of control. These also will control other pests: Delegate is labeled for control of fruitworms, leafrollers and for suppression of gall midge, maggot, and thrips; Rimon for fruitworms, spanworm, leafrollers and maggot; and Avaunt for fruitworms and spanworm, with activity also expected on plum curculio.

Coverage is critical

For any insecticide applied for fruitworm control, maintaining good coverage of the clusters is important, to get residue to the parts of the berry where fruitworms are found such as in the calyx cup where eggs are laid. Because the larvae move over such a small distance before they enter the berries, it is important to use sufficient water and to consider spray additives (spreader-stickers) that will help spread the material across the berry surface. This is especially important for insecticides that need to be eaten for activity such as B.t. and Intrepid.

On-farm fruitworm control trials

In 2009, we compared the level of fruitworm control at three 1-9 acre fields in each of four commercial blueberry farms in southwest Michigan (two in Ottawa and two in Van Buren counties). At each farm, three fields with a history of fruitworm infestation were compared that received one of three programs comprised of insecticide applications at bloom, petal fall, and 7-10 days after petal fall. The three programs were (rates are all per acre): A) Confirm at 16oz, Guthion at 1.25 lb, Guthion at 1.25 lb, B) Confirm at 16 oz, Asana at 9.6 oz, Asana at 9.6 oz or Mustang Max at 4 oz, and C) Intrepid at 8 oz applied using the degree day model, Intrepid at 8 oz 10-14 days later, and Assail at 5.3 oz 7-10 days later.

All three programs were effective at protecting fruit from fruitworm damage. Single berry damage (indicative of cherry fruitworm damage or the early stages of cranberry fruitworm feeding) was lowest in Program C, but this was not significantly different between programs: A) 1.1% damaged berries, B) 0.7% damaged berries, C) 0.5 % damaged berries. Similar results were seen for multiple berry damage, which is a sign of advanced cranberry fruitworm feeding. No multiple berry damage was found in any fields treated with the IPM program and very low levels of multiple berry damage were seen in the other programs. The percentage of berries with cranberry fruitworm damage was well below 1 % in all fields and there was no significant difference among treatments.

Fruit collected from these fields and then held to measure larvae surviving to pupae revealed 2 CBFW in the Guthion program,1 in the Pyrethroid program, and zero in the Intrepid-Assail program. One CFW was found in the Optimal IPM program, but none in the others.

SUMMARY

Fruitworm management can be highly effective if regular checking of monitoring traps is combined with tracking of degree days and application of effective insecticides. Our recent studies have demonstrated the excellent control provided by Intrepid/Assail and Confirm/Asana programs for controlling fruitworms, providing alternatives for growers preparing for the loss of Guthion. There are other options available for growers to consider to work into their IPM program while keeping resistance management in mind. Although the Intrepid/Assail program was more costly than the Guthion or Pyrethroid-based programs, insecticide costs of Assail and Intrepid are declining, and not all farms or fields will require three

sprays for fruitworm control. Combining monitoring with degree days for accurate timing of early fruitworm sprays can help minimize economic losses to this complex of early-season moth pests.

Rufus Isaacs[1], Carlos Garcia-Salazar[2], John Wise[1], Keith Mason[1], and Steve Van Timmeren[1]

[1]Department of Entomology, Michigan State University

[2]Michigan State University Extension

2010 grower meetings

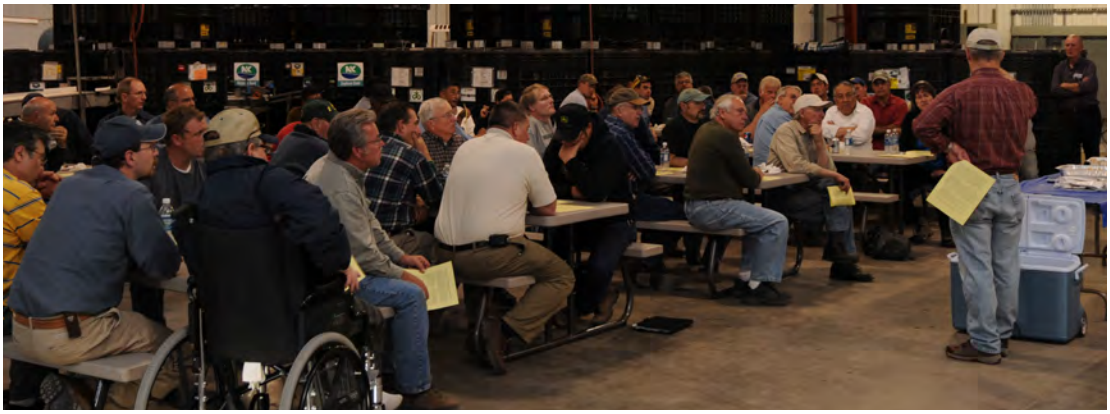
MAY 6 **6:00PM**
Pre-bloom meeting - Ottawa county
Location: Carini Farms
15039 Port Sheldon Rd., West Olive
Information: Carlos Garcia, 269-260-0671

JUNE 10 **6:00PM**
Pre-harvest meeting - Van Buren County
Location: to be determined
Information: Mark Longstroth, 269-330-2790

JUNE 17 **6:00PM**
Pre-harvest meeting - Ottawa County
Location: Carini Farms
15039 Port Sheldon Rd., West Olive
Information: Carlos Garcia, 269-260-0671

JUNE 24 **6:00PM**
Weed Control Demo - Allegan County
Location: Getzoff Farm
7093 116th St., Fennville
Information: Paul Jenkins, 517-648-5099

MICHIGAN STATE UNIVERSITY EXTENSION



Many thanks to the Bodtke's for hosting our first grower meeting last Thursday!

Photo: Mark Longstroth, MSU Extension, addresses a full house on April 29th.

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